REMARKS

Introduction

Claims 11-20 are pending. Claims 21-32 are new. For at least the reasons discussed below, all of the claims are in condition for allowance.

Prior Art Rejections

The Office Action has rejected claims 11, 12, 14-16, 19, 20 under 35 U.S.C. § 103(a) over "A Survey of Event Filtering Mechanisms for Dynamic Multi-point Applications" by Ehab S. Al-Shaer et al ("Al-Shaer") in view of "Data Structures with C++" by William Ford et al ("Ford"). The Office Action has rejected claim 13 under 35 U.S.C. § 103(a) over Al-Shaer in view of Ford and further in view of U.S. Patent 5,666,528 to Lam H. Thai ("Thai"). The Office Action has rejected claim 17 under 35 U.S.C. § 103(a) over Al-Shaer in view of Ford, in view of Thai, and further in view of U.S. Patent 6,405,191 B1 to Bhatt et al ("Bhatt"). The Office Action has rejected claim 18 under 35 U.S.C. § 103(a) over Al-Shaer in view of Thai, and further in view of U.S. Patent 6,493,703 B1 to Knight et al ("Knight"). Applicants respectfully traverse these rejections. In the following, Applicants provide an overview of their invention and then discuss the differences with respect to Al-Shaer, Ford, Thai, and Knight.

Applicants' technique is generally directed towards automatic filtering of events using a composite event filtering mechanism to notify event subscribers when a query of interest occurs. To constrain an event filtering tree from growing

exponentially when representing queries having multiple parameters, Applicants' technique creates a composite event filtering tree from two or more event filtering trees using a boolean constructor to reduce the overall size of trees required for processing the queries. In specific, a parent node with the OR operator may have two or more children representing event parameters. Each of the children may include a plurality of values that the event parameter may represent and which may be used to select two or more leaf nodes of the child. Each leaf node may include a boolean value that indicates if a query is satisfied. When notification of the occurrence of an event is received, the composite event filtering tree may be traversed to evaluate queries. During tree traversal, a branch may be made to one of the children of a parent node with the OR operator. The actual event data may be evaluated against the plurality of values that the event parameter may represent while visiting the child node to selectively branch to one of the leaf nodes to obtain first query information. A branch may also be made to another one of the children of the parent node with the OR operator so that another event parameter may be evaluated to selectively branch to one of the leaf nodes to obtain additional query information as necessary to evaluate the query. If a query is satisfied after traversing the tree, an event subscriber may be notified that the query was satisfied. Advantageously, such a composite event filtering tree may require a lesser number of nodes than are needed to represent individual event filtering trees for evaluating the same set of queries. Note that the above description is for example and informational

purposes only, and should not be used to interpret the claims, which are discussed below.

Al-Shaer, in general, is a survey providing an overview of known event filtering mechanisms for dynamic multi-point applications, including event filters represented by a boolean expression tree and a directed acyclic graph. Each of these techniques cited by the Office Action is very different from the present invention. First of all, a boolean expression tree is a binary tree as defined in Al-Shaer. Each interior node in the binary tree represents a boolean operation. Each edge in the tree connects the operator (parent node) with its operand (child node). (Al-Shaer, section 3.2.1, lines15-20). The algorithm for manipulating a boolean expression tree is based on a bottom-up parse of the tree. Events are classified by evaluating the tree starting at the leaves and propagating the results up to the binary operator at the root. The event is matched if the root of the tree evaluates to "true." (Al-Shaer, section 3.2.1, lines 21-27.) Second, the nodes of the directed acyclic graph as defined by Al-Shaer represent test predicates and the edges represent control transfer. The directed acyclic graph is parsed top-down such that if the test predicate is true, the right-hand edge is traversed, otherwise the left-hand edge is traversed. The test predicate determines the edge to traverse. An event is matched if the terminating node (leaf node) is denoted as true. (Al-Shaer, section 3.2.1, lines 36-41).

In contrast to the claims of the present invention, the boolean expression tree of Al-Shaer is a binary tree and may not have more than two branches per node as claimed by Applicants. Moreover, each interior node in the boolean

expression tree as defined in Al-Shaer represents a boolean operation and does not represent an event parameter as some interior nodes do in Applicants' claims. Furthermore, events are evaluated based on a bottom-up parse of the tree starting at the leaves and propagating the results up to the binary operator at the root. Applicants' technique employs a top-down traversal of the tree starting with a boolean operator and obtaining query results from the leaves of the tree. Unlike Applicants' technique where a query may be satisfied if a *leaf* of the tree is "true", an event is matched in Al-Shaer's boolean expression tree if the *root* of the tree evaluates to "true." Just as Al-Shaer's boolean expression tree is significantly different from Applicants' composite event filtering tree, so is Al-Shaer's directed acyclic graph. Each interior node in Al-Shaer's directed acyclic graph represents test predicates and there are no interior nodes defined to be a boolean operation as claimed by Applicants. Each interior node in Al-Shaer's boolean expression tree represents a boolean operation and there are no interior nodes defined to be an event parameter as claimed by Applicants. Neither Al-Shaer's boolean expression tree nor Al-Shaer's directed acyclic graph are created using a boolean constructor as disclosed and claimed by Applicants. Each and every one of these differences is significant.

Turning first to independent claim 11, Applicants recite the limitations of "reaching an OR node, branching to a child node of the OR node" and "performing a first evaluation of the child node against information of the event." Applicants' technique may construct a composite event filtering tree from two or more event filtering trees using a boolean constructor to create a parent node

having the boolean OR operator and two or more children representing event parameters having a plurality of values. The cited sections of Al-Shaer do not disclose any such limitations as alleged by the Office Action. Instead, Al-Shaer presents general terminology as background for his survey of event filtering. (Al-Shaer, section 2.1, lines 5-43.) For example, Al-Shaer explains that an operator by definition may generally be used to join predicates of an event filter to construct arbitrarily complex predicates. He further explains that a filter is a set of predicates joined by operators. (Al-Shaer, section 2.1, lines 37-42.) In discussing basic terminology of event filtering, nowhere does Al-Shaer disclose the limitations of branching to a child node of an OR node and evaluating the child node against information of the event. Nor does Al-Shaer describe using a boolean constructor to create a parent node having the boolean OR operator and two or more children representing event parameters having a plurality of values.

The Office Action also cites another section of Al-Shaer, section 3.2.1, lines 5-50, as allegedly disclosing the limitations of branching to a child node of an OR node and evaluating the child node against information of the event. Al-Shaer does not disclose any such limitations, but instead provides background regarding two known primitive event classifiers: a boolean expression tree and a directed acyclic graph. The boolean expression tree and a directed acyclic graph described by Al-Shaer are significantly different from Applicants' technique. Each interior node in the boolean expression tree as defined in Al-Shaer represents a boolean operation and does not represent an event parameter as some interior nodes do in Applicants' claims. Furthermore, events are evaluated

based on a bottom-up parse of the tree starting at the leaves and propagating the results up to the binary operator at the root. Applicants' technique employs a top-down traversal of the tree starting with a boolean operator and obtaining query results from the leaves of the tree. Each interior node in Al-Shaer's directed acyclic graph represents test predicates and there are no interior nodes defined to be a boolean operation as claimed by Applicants. Each interior node in Al-Shaer's boolean expression tree represents a boolean operation and there are no interior nodes defined to be an event parameter as claimed by Applicants. Nowhere in the description of these two known primitive event classifiers does Al-Shaer disclose the limitations of branching to a child node of an OR node and evaluating the child node against information of the event. In fact, Al-Shaer could not disclose such limitations because Al-Shaer's boolean expression tree and Al-Shaer's directed acyclic graph are not created using a boolean constructor as disclosed and claimed by Applicants. Consequently, neither Al-Shaer's boolean expression tree nor Al-Shaer's directed acyclic graph could include a parent node having the boolean OR operator and two or more children representing event parameters having a plurality of values.

Similarly, independent claim 19 of the present invention recites the limitations of "an OR node" and "a first child node representing a first event parameter" and "a second child node representing a second event parameter." Again, Al-Shaer does not disclose any such limitations. The Office Action refers to the same sections of Al-Shaer cited as allegedly disclosing the limitations of claim 11. Applicants need not repeat the many significant differences between

Al-Shaer's boolean expression tree and Al-Shaer's directed acyclic graph as previously discussed above. None of the sections of Al-Shaer cited as allegedly disclosing the limitations of claim 11 disclose either the limitations of claim 11 or the limitations of claim19. Nor could they, because Al-Shaer's boolean expression tree and Al-Shaer's directed acyclic graph do not include a parent node having the boolean OR operator and two or more children representing event parameters having a plurality of values.

Ford is cited by the Office Action for teaching traversing a tree. Indeed, Ford does teach a recursive inorder traversal of a binary tree that is well known in the art of data structures. However, this well known traversal technique is different from the traversal disclosed and claimed by Applicants for traversing Applicants' composite event filtering tree. During traversal of Applicants' composite event filtering tree, a branch may be made to any one of the children of a parent node with the OR operator as recited in claim 11 "reaching an OR node, branching to a child node of the OR node." The branching does not need to be inorder from left to right as disclosed by Ford. The actual event data of a child may in turn be evaluated against the plurality of values that the event parameter may represent while visiting the child node to selectively branch to one of the leaf nodes. Again, branching to a leaf node from a child node does not need to be inorder from left to right. Indeed, a branch may also be made to another one of the children of the parent node with the OR operator so that another event parameter may be evaluated to selectively branch to one of the leaf nodes to obtain additional query information as necessary to evaluate the

query. Ford's recursive inorder traversal of a binary tree is significantly different from the traversal technique disclosed and claimed by Applicants for evaluating queries using Applicants' composite event filtering tree.

Regarding the dependent claims, Applicants respectfully submit that dependent claims 12-18 and 20, by similar analysis, are not anticipated by Al-Shaer or Ford, either together or alone. Each of the dependent claims generally includes the limitations of a node having the boolean OR operator and two or more children representing event parameters. As discussed above, neither Al-Shaer, nor Ford, disclose these limitations together or individually. In addition to the limitations noted above, each of these dependent claims includes additional patentable elements.

For example, claim 13 recites the limitation of "the query information in each leaf node identifies at least one query satisfied thereby, and wherein using the query information includes determining which subscribers correspond to each satisfied query." In Applicants' technique, the composite event filtering tree may be traversed as described above to selectively branch to one of the leaf nodes to obtain query information. Each leaf node may include a boolean value that indicates if a query is satisfied. None of the sections of Al-Shaer cited disclose this limitation, nor does Thai as alleged. Thai instead is generally directed to the area of database management systems and optimized methods for querying information from those systems and is completely unrelated to Applicants' invention as disclosed and claimed. The cited section of Thai generally describes global and local filtering of database records using a traditional logical

query. Thai does not remotely relate to a leaf node, much less determining which subscribers correspond to a satisfied query.

As another example, claim 17 recites the limitation of "the set of queries is received from an event subscriber." None of the sections of Al-Shaer cited disclose this limitation as acknowledged by the Office Action, but nor does Knight as alleged. Knight instead is generally directed to the area of online message boards and is completely unrelated to Applicants' invention as disclosed and claimed. The cited section of Knight generally describes organizing raw newsgroup data to adjust content to suit changing online community interests. Knight does not remotely relate to event filtering, much less satisfying a set of queries received from an event subscriber using a composite event filtering mechanism.

As a third example, claim 18 recites the limitation of "the set of queries is received from an event provider." None of the sections of Al-Shaer cited disclose this limitation as acknowledged by the Office Action, but nor does Knight as alleged. Knight instead is generally directed to the area of online message boards and is completely unrelated to Applicants' invention as disclosed and claimed. The cited section of Knight generally describes supplementing service provider queries for online content with community based queries to identify new content of general interest to a particular online community. Knight does not remotely relate to event filtering, much less satisfying a set of queries received from an event provider using a composite event filtering mechanism.

For at least these significant reasons, Applicants submit that all the claims are patentable over the prior art of record, including Al-Shaer, Ford, Thai and Knight, taken either together in any permissible combination or alone.

Further, by law, in order to modify a reference to reject claimed subject matter, there must be some teaching or suggestion outside of Applicants' teachings to do so. Neither Al-Shaer nor Ford have any such teachings or suggestions as to any such modification, let alone any teaching or suggestion as to how either system could be modified, or why it might be desirable to do so. In specific, the motivation described by Al-Shaer for providing his survey of known event filtering mechanisms is to describe the primary characteristics and limitations in existing high-performance event filtering mechanisms. Al-Shaer acknowledges that existing tools for event filtering do not adequately address the usability, extensibility, performance and scalability requirements of dynamic multi-point applications. In particular, Al-Shaer discloses that his current research efforts for improving performance and scalability are directed to optimization techniques employing parallel processing, dynamic tri-based search structures, and compiler technology based on context-free grammars to reduce the time required to filter events. Thus, Al-Shaer teaches away from Applicants' composite event filtering tree. Applicants' technique may actually increase the time required to filter events since Applicants' technique employs a strategy of trading time over space, but improves scalability of complex event filtering by reducing the space required for event filtering trees. The only other way in which

Al-Shaer could be modified to reach Applicants' claimed invention is via Applicants' own teachings, which is impermissible by law.

For at least these additional reasons, Applicants submit that all the claims are patentable over the prior art of record, including new claims 21-32. Each of the new claims 21-25 also generally includes the limitations of a node having the boolean OR operator and two or more children representing event parameters. And each of the new claims 26-32 also generally includes the limitation of traversing a composite event filtering tree created using a boolean constructor for determining at least one query satisfied by events. As discussed above, none of the prior art of record disclose these limitations together or individually. In addition to these limitations, each of the dependent claims 22-25 and 27-32 includes additional patentable elements. Reconsideration and withdrawal of the rejections in the Office Action is respectfully requested and early allowance of this application is earnestly solicited.

Conclusion

In view of the foregoing remarks, it is respectfully submitted that claims 11-32 of the present application are patentable over the prior art of record, and that the application is in good and proper form for allowance. A favorable action on the part of the Examiner is earnestly solicited.

If in the opinion of the Examiner a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney at (425) 836-3030.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that this Amendment, Transmittal and Petition for Extension of Time are being deposited with the United States Postal Service on the date shown below, with sufficient postage as first class mail, in an envelope addressed to: Assistant Commissioner for Patents, Alexandria, VA 22313.

Date: December 19, 2003

Albert S. Michalik